



**US Army Corps  
of Engineers®**



## **Limited Visual Dam Safety Inspections**

**OA00021**

**Kemoo 5 Reservoir**

**Oahu, Hawaii**

**Prepared by:**

**U.S. ARMY CORPS OF ENGINEERS  
HONOLULU DISTRICT**

**STATE OF HAWAII  
DEPARTMENT OF LAND AND NATURAL RESOURCES**

**May 2006**

Limited Visual Dam Safety Inspection Conducted on: April 4, 2006.

**I. Purpose:**

Due to disaster occurrences of periodic heavy rains and flooding, which has caused extensive damage to property and loss of lives, the Governor has issued a State of Emergency Proclamation extending from February 20, 2006 to April 9, 2006. In light of the tragic failure of the Kaloko dam on Kauai and the continued forecast of heavy rains, emergency inspections of all regulated dams in all counties are being undertaken.

These inspections are for the purpose of determining if any of the regulated dams and reservoirs in the City and County of Honolulu, Maui County or Hawaii County, are suspect for immediate concern to the downstream area under the prolonged conditions of heavy rain showers.

**II. Authority**

Inspections are authorized under the Hawaii Dam Safety Act of 1987, Chapter 179D "Dams and Reservoirs" of Hawaii Revised Statutes, and Title 13, Subtitle 7, Chapter 190, "Dams and Reservoirs" of the Hawaii Administrative Rules.

These inspections are being conducted under joint agreements of the U.S. Army Corps of Engineers (ACE), the U.S. Department of Agriculture Natural Resources Conservation Service (NRCS), and the State of Hawaii. The Memorandum of Agreement with the U.S. Army Corps of Engineers is entered into pursuant to 10 U.S.C. § 3036(d)(2), and the Intergovernmental Cooperation Act (31 U.S.C. §6505), and established via support agreement number DL-06-01.

**III. Scope**

Visual inspections were made on parts of the embankment and appurtenant works readily available and visible for inspection by the inspection team at the time of the inspection. Such parts and appurtenant works would include the upstream slope, crest, downstream slope, abutments and toes, outlet works, and spillway.

On the date of this limited visual inspection, there appeared to be no immediate threat to the safety of the dam, however no assurance can be made regarding the dam's condition after this date. Subsequent adverse weather and other factors may affect the dam's condition.

**IV. Limitations of Findings and Recommendations**

The inspection is based only on visible features/areas of the dam on the day of inspection. The inspection does not entail detailed stability, hydrologic, hydraulic, or seismic investigations. This inspection is not a formal phase I or phase II dam safety inspection and does not include a review or evaluation from each specialist of an inspection team, such as a geologists, civil, geotechnical, structural, or hydraulics engineer. The owner should verify the findings of this report and take corrective actions. The owner may submit to the State alternative corrective actions that are certified by a licensed professional engineer in the State of Hawaii experienced in the design and construction of dams. This inspection does not relieve the owner/operator from their responsibility to conduct routine inspections, maintenance, repairs, modifications, monitoring, documentation, and/or investigative studies.

**Dam ID: OA-021**  
**Name: Kemoo 5 Reservoir**

**V. Inspection Team**

Organization

State of Hawaii, Dept. of Land and Natural Resources  
NRCS  
US Army Corps of Engineers

Name /Title

Carty Chang  
Mike Hayama  
Ray Kong

**VI. Owner's Representatives Present**

Mr. Gary Paracuellas

**VII. Summary Report Team**

Organization

US Army Corps of Engineers  
  
State of Hawaii, Dept. of Land and Natural Resources

Name /Title

Mr. Derek Chow  
Mr. Joseph Koester  
Ms. Denise Manuel  
Mr. Edwin Matsuda

**VIII. Dam Type**

The dam is an earthen embankment dam.

**IX. Dam Classification**

The current hazard classification of this dam is: Significant  
Based on available data, this classification is believed to still be applicable.

Hazard Potential Classification based on the following:

Category	Loss of Life	Economic Loss
Low	None Expected	Minimal (undeveloped to occasional structures or agriculture)
Significant	Few (No Urban development and no more than a small number of inhabitable structures)	Appreciable (Notable agriculture, industry or structures)
High	More than a few	Extensive community, industry or agriculture.

Based on inventoried storage and height data, the size classification of the dam is: Small

Size Classification based on the following:

Category	Storage (Acre-Feet)	Height (feet)
Small	< 1000	< 40
Intermediate	> 1000 and < 50,000	> 40 and < 100
Large	> 50,000	> 100

**X. Summary of Inspection:**

Condition Rating Criteria: The conditional terms in this report are used to generally describe the conditions below. Inspections, monitoring, and additional investigations are considered to be incidental to all condition ratings.

Satisfactory	Expected to fulfill intended function.
Fair	Expected to fulfill intended function, but maintenance is recommended.
Poor	May not fulfill intended function; maintenance or repairs are necessary.
Unsatisfactory	Is not expected to fulfill intended function; repair, replacement, or modification is necessary.
Unknown	Not visible, not accessible, not inspected, or unable to determine the condition rating based on the observation taken.

**A. General appearance:**

Some of the dam features were easily recognizable. However the overall condition of the downstream slope of the dam is not known due to heavy vegetation.

Modifications / Improvements: There were no signs of any recent modifications.

The reservoir appeared to have a small surface drainage area.  
Based on staff personnel, this reservoir had no incident history.

**Findings and Corrective Actions:**

- a. The Owner shall maintain documentations including improvements, modifications, Operations and Maintenance Manuals and routine inspection logs for this dam facility.
- b. An Emergency Action Plan (EAP) does not exist for this dam.
- c. An EAP is recommended for all dams regardless of hazard class. Submit EAP if developed for the facility.
- d. Submit narrative and additional information detailing the improvements, modifications, and/or alterations at the dam site, unless covered by approved dam permit.
- e. Routine inspection logs were not inspected.
- f. Dam owners shall provide for routine inspection of the dam.
- g. The dam did not appear to be maintained on a regular basis.
- h. Access to site appears to be satisfactory.
- i. Provide a detailed narrative of any recalled past incidents, responses taken, and any damages incurred. Dam owners are required to promptly advise the department of any sudden or unprecedented flood or unusual or alarming circumstance or occurrences which may adversely affect the dam or reservoir.
- j. Submit current Operations and Maintenance Manual or Procedures for this dam / reservoir facility.

- k. Submit Site or Facility Map of this Dam which identifies the location of major features including outlet works controls and conduits.
- l. Emergency Alarms / Monitors. There were no alarms or monitors observed on this reservoir.
- m. Power / Communication. There were no communication systems observed on this reservoir.

**B. Access / Security:**

A four wheel drive vehicle is not required.

Access to dam is questionable during severe weather conditions.

Operational plans need to reflect this deficiency or access improved.

Security issues. Access to the dam is via a locked gate.

**C. Intake Works:**

The intake or inlets have the ability to be shut off or diverted away from the reservoir during periods of heavy rains. This is done manually.

Findings and Corrective Actions:

- a. The intake works were inspected only for the short length leading into the reservoir.
- b. The intake works were not tested.
- c. The intake works appeared to be in satisfactory condition, no corrective actions are required at this time.

**D. Reservoir**

The reservoir level during the inspection was about 5 feet below crest height.

According to staff personnel, the reservoir is normally operated at the level observed during the inspection.

Findings and Corrective Actions:

- a. The reservoir was not inspected underwater and in areas obstructed by vegetation.
- b. The reservoir appeared to be in satisfactory condition, no corrective actions are required at this time.
- c. A staff gage was not observed at the reservoir. Provide some method of quantifying the water level within the reservoir.

**E. Upstream Slope (Satisfactory)**

The upstream slope varied in slope and ranged from a 1V:1H (Vertical/Horizontal) or steeper. There was no slope protection observed.

Erosions were not observed, the slope was not entirely visible.

Cracks were not observed, the slope was not entirely visible.

Sinkholes were not observed, the slope was not entirely visible.

The upstream slope was not entirely visible due to vegetation and being underwater for a portion of the slope.

Findings and Corrective Actions:

- a. The upstream slope was not inspected underwater and in areas of vegetation.
- b. The upstream slope appeared to be in satisfactory condition, no corrective actions except a analysis of the slopes should be performed to determine the stability of the slope in it's present condition.

**F. Crest: (Satisfactory)**

The dam crest was approximately 15 feet wide

There was a dirt access road on top of the crest which appeared to be well utilized.

Minor erosion was observed, limited primarily to tire ruts and some small gullies from surface drainage flowing down the downstream slope. Cracks were not observed, however the crest was not entirely visible. Vegetation was observed on the edges of the crest. These were primarily high grass.

Findings and Corrective Actions:

- a. The dam crest appeared to be in satisfactory condition, no corrective actions are required at this time.

**G. Downstream Slope: (Fair)**

The downstream slope was in fair condition and not visible due to heavy vegetation.

The slope was very steep, around a 1 to 1 slope.

There was no access to the downstream slope.

There was no slope protection observed on the downstream slope.

Erosion was not observed on the downstream slope, however the slope was not entirely visible.

Sinkholes were not observed on the downstream slope, however the slope was not entirely visible.

Vegetation was observed on the downstream slope. The majority of the vegetation was tall grass, bushes and woody trees.

The downstream toe was not inspected due to access.

Findings and Corrective Actions:

- a. The majority of the downstream slope and all of the toe was not inspected.
- b. The downstream slope appeared to be in fair to poor condition and requires corrective action.
- c. The down stream slope was not visible due to high grass and bush vegetation. Clear high vegetation and maintain low to enable easy visual inspection.

- d. Tree(s) were observed on the downstream slope. Trees have been identified as the probably cause of piping failures, and can possibly cause severe damage to the embankment if they are uprooted during a high winds. Corrective action is required to remove the tree hazards from the dam. Acceptable remedies include removal of the tree and its root structure down to a 2" diameter and reconstructing the damaged embankment section. All repair work shall be accomplished as per the requirements of licensed geotechnical or structural engineer. Routinely monitor the damaged area for signs of settlement and seepage.
- e. The slope was very steep, around a 1 to 1 slope, further study is required to verify slope stability.

**H. Abutments / Toe: (Unknown)**

The abutments and toe were not entirely visible or identifiable due to heavy vegetative growth. There was heavy vegetation along the abutments and toe locations.

Findings and Corrective Actions:

- a. The abutments/toe were not inspected.
- b. The abutments/toe appeared to be in fair to poor condition and requires corrective action.
- c. The abutment/toe area was not visible due to high grass and bush vegetation. Clear high vegetation and maintain low to enable easy visual inspection.

**I. Outlet Works: (Unknown)**

Not inspected due to inaccessibility, also it was not tested.

Findings and Corrective Actions:

- a. The outlet works were not inspected.
- b. The outlet works were not tested.

**J. Spillway: (Unsatisfactory)**

No spillway was observed and according to staff personnel none exists.

Findings and Corrective Actions:

- a. The Spillway appeared to be in unsatisfactory condition and not expected to fulfill its intended function. Urgent corrective action is required.
- b. Even with a controlled inflow works, a spillway is required to be designed and constructed with adequate capacity.
- c. Provide a spillway or other mitigative action to prevent overtopping.

**K. Down Stream Channel: (Unknown)**

The down stream channel was not investigated.

Findings and Corrective Actions:

- a. The downstream channel was not inspected.

Dam ID: OA-021

Name: Kemoo 5 Reservoir

**XI. Additional Comments:**

Attached are photos taken of the dam features as well as other items observed during our inspection. A scanned copy of the original field notes are attached for this visual inspection.

Per e-mail dated 5/12/06, 3:47 pm from Ray Kong, USACE

Please describe vehicle access to site: **Standard.**

Please describe access during rains: **4-wheel drive.**

Please describe access when spillway is flowing: with standard car or requires 4-wheel drive

**No spillway exists.**

Reservoir:

Staff gage - Please indicate corrective action.

**Staff gage was not observed at the reservoir. Provide some method of quantifying the water level within the reservoir. No staff gage found so this should be an action item for the owner to install.**

Outlet works:

Was the outlet not observed due to heavy vegetation?

**Heavy vegetation and no access found.**

Comments:

Please indicate if the dam presented a safety hazard at the time of inspection. How immediate is a spillway needed? Also, if the outlet works were not accessible, please state what is needed to be corrected, and time frame. Should it be corrected immediately (within 6 months)? Would it be in their best interest to have a structural or geotechnical engineer assist them with the corrective action(s)?

**No immediate threat found on date of inspection. Construction of spillway is required in a proper dam structure design. All elements of the dam/reservoir not accessible should be made accessible and a re-inspection by qualified personnel be made.**



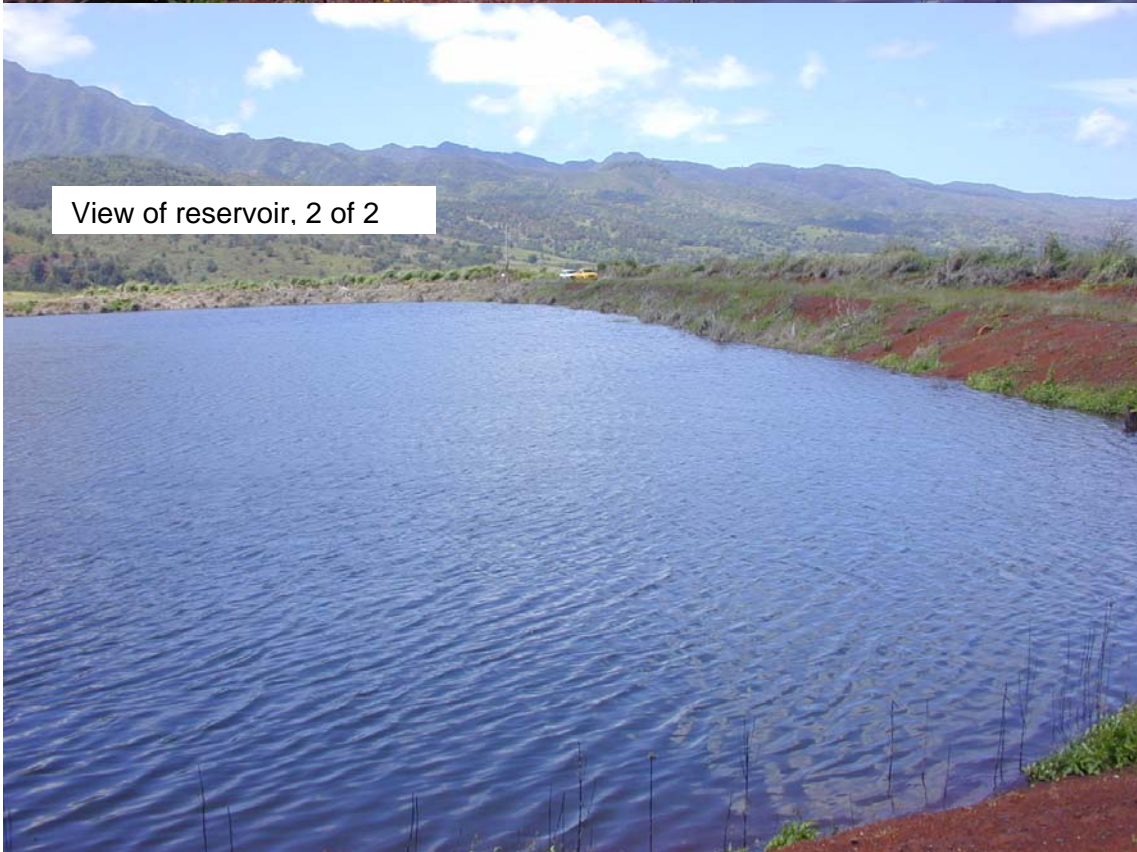
## PHOTOGRAPHS

**Dam ID: OA-021**

**Name: Kemoo 5 Reservoir**



View of the reservoir, 1 of 2



View of reservoir, 2 of 2



Dam ID: OA-021

Name: Kemoo 5 Reservoir





Dam ID: OA-021

Name: Kemoo 5 Reservoir



View of downstream slope,  
notice heavy vegetation



View of inlet flow area to  
reservoir, notice heavy  
vegetation



Dam ID: OA-021

Name: Kemoo 5 Reservoir



## **FIELD INSPECTION SHEETS**

Dam ID: OA-0021  
KEMOO 5 RESERVOIR

**Vulnerability Index:**  
Extreme High Moderate Low  
1 2 3 4

Inspection No: \_\_\_\_\_  
Date: 4/3/06

STATE OF HAWAII - DLNR  
DAM SAFETY INSPECTION SHEET

Inspection Type: Visual Dam Safety Inspection

Persons Present	Affiliation	Phone Number
<u>RAY KONG</u>	<u>US Army Corps of Engineers</u>	
<u>CARTY CHANG</u>	<u>DLNR</u>	
<u>MIKE HAYAMA HAYAMA</u>	<u>NRCS</u>	
<u>GARY PARCELLUS</u>	<u>DOLE FOODS</u>	

Weather Condition: ☐ Rain previous day ☐ Rainy ☐ Drizzle / Mist ☐ Cloudy/Overcast ☐ Partly Cloudy ☒ Sunny ☐ Dry  
Comments: \_\_\_\_\_

**1. General:** (Information currently on file, update as required)

Dam/Res. Name	<u>KEMOO 5 RESERVOIR</u>		
Owner	<u>Dole Food Company Hawaii</u> (C005)		
Owner Contact	<u>Mr. Gary Paracuellas</u>	Owner Ph.	_____
Lessee	_____	Lessee Ph.	_____
O & M Contractor	_____	O & M Ph.	_____
Nearest Town	<u>THOMPSON CORNER</u>	Latitude	<u>21.5583 ° (decimal)</u>
County	<u>HONOLULU</u>	Longitude	<u>158.1067 ° (decimal)</u>
Tax Map Key(s)	<u>1-6-5-001:002</u>		

Dam Status	<u>A:</u>	Hazard Potential	<u>S:</u>	Dam Size	_____
Year Completed	<u>1920</u>	Dam Length	<u>650 ft.</u>	Dam Height	<u>21 ft.</u>
Normal Storage	<u>63 ac.ft.</u>	Max. Storage	<u>63 ac.ft.</u>	Max. Surface Area	<u>0 ac.</u>
Drainage Area	<u>0 mi.</u>	Spillway Type	_____	Max. Spillway Q	<u>167 cfs</u>

Owner owns land under dam facility: \_\_\_\_\_

Emergency Action Plan on file with the Department: NO

Reports on file with the Department: December 1996 = RMTC, Phase I Study (Only original)

Dam ID: OA-0021  
KEMOO 5 RESERVOIR

Inspection No: \_\_\_\_\_  
Date: 9/3/06

**2. Questions for Owner's Rep.:**

	Yes	No	Unknown	Comments
Construction Plans Available	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Site / Facility Map	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Operation & Maintenance Manual	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Emergency Action Plan	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Modifications / Improvements	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Conduct Routine Inspections	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Conduct Routine Maintenance	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Vehicle access to site	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> Not accessible <input type="checkbox"/> With Standard car <input type="checkbox"/> Requires 4-Wheel Drive
Access during heavy rains	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> Not accessible <input type="checkbox"/> With Standard car <input type="checkbox"/> Requires 4-Wheel Drive
n/a Access when spillway is flowing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> Not accessible <input type="checkbox"/> With Standard car <input type="checkbox"/> Requires 4-Wheel Drive
Other Studies Conducted	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> Phase I <input type="checkbox"/> Phase II <input type="checkbox"/> Hydraulics <input type="checkbox"/> Stability <input type="checkbox"/> Hazard <input type="checkbox"/> Seismic <input type="checkbox"/> Other: _____
No Spillway Incident History	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> Breached <input type="checkbox"/> Overtop <input type="checkbox"/> Slide <input type="checkbox"/> Down stream Flooding <input type="checkbox"/> Other: _____
Reservoir's Current Use	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> Sediment <input checked="" type="checkbox"/> Irrigation <input type="checkbox"/> Recreation <input type="checkbox"/> Flood Control <input type="checkbox"/> Drinking Water <input type="checkbox"/> Power Generation <input type="checkbox"/> Other: _____

**Findings and Corrective Actions:**

- ☒ a. The Owner shall maintain documentations including Construction plans, specifications, improvements, modifications, Operations and Maintenance Manuals and routine inspection logs for this dam facility. *9/23/06 revision*
- ☐ b. An Emergency Action Plan (EAP) is on file with the department, submit any updates as applicable.
- ☐ c. An EAP is required for High Hazard Dams. Submit an updated EAP for this facility.
- ☒ d. An EAP is recommended for all dams regardless of hazard class. Submit EAP if developed for the facility. *4/23/06*
- ☐ e. Submit narrative and additional information detailing the improvements, modifications, and/or alterations at the dam site, unless covered by approved dam permit.
- ☒ f. Routine inspection logs were not inspected.
- ☒ g. Dam owners shall provide for routine inspection of the dam.
- ☐ h. The dam did not appear to be maintained on a regular basis.
- ☒ i. Access to site appears to be satisfactory.
- ☐ j. There is no vehicular access to the dam site. Operational and emergency plans need to reflect this deficiency or access provided.
- ☐ k. Access to dam is questionable during severe weather conditions and/or spillway overflows. Operational plans and emergency plans need to reflect this deficiency or access provided.
- ☐ l. Provide a detailed narrative of the incident, responses taken, and any damages incurred. Dam owners are required to promptly advise the department of any sudden or unprecedented flood or unusual or alarming circumstance or occurrences which may adversely affect the dam or reservoir.
- ☒ m. Submit current Operations and Maintenance Manual or Procedures for this dam / reservoir facility. *9/23/06*
- ☒ n. Submit Site or Facility Map of this Dam which identifies the location of major features including outlet works controls and conduits. *9/23/06*
- ☐ o. \_\_\_\_\_

**Additional Requirements:**

The following investigative study(s) are:

Required	Recommended	
<input type="checkbox"/>	<input type="checkbox"/>	Phase I Study
<input type="checkbox"/>	<input type="checkbox"/>	Phase II Study (Including <input type="checkbox"/> Seepage <input type="checkbox"/> Hydrology/Hydraulics <input type="checkbox"/> EAP)
<input type="checkbox"/>	<input type="checkbox"/>	Hydrology and Hydraulics (including Probable Maximum Flood and spillway capacity)
<input type="checkbox"/>	<input type="checkbox"/>	Stability Analysis
<input type="checkbox"/>	<input type="checkbox"/>	Seismic Analysis
<input type="checkbox"/>	<input type="checkbox"/>	Hazard Classification
<input type="checkbox"/>	<input type="checkbox"/>	Other: _____



Dam ID: OA-0021  
KEMOO 5 RESERVOIR

Inspection No: \_\_\_\_\_  
Date: 4/3/06

**Physical Dam Features:** (Check All Applicable. Provide description of Items Observed and/or Take Photos. Indicate photo # in description.)

**3. Reservoir:**

Level during inspection + 5' below crest ft per \_\_\_\_\_ (gage / other) ~~not available~~  
Normal Operating Level/Range same ft per \_\_\_\_\_ (gage / other)  
Description: ~~Information not available~~  
Typical Operation ☐ Spillway always flowing ☐ Kept within normal range ☐ Kept Empty ☐ Drained Daily ☐ Only filled by Storms  
☐ Other: none no spillway  
Sinkhole in Res.: ☐ # Observed: \_\_\_\_\_ Size: \_\_\_\_\_ by \_\_\_\_\_ in. Deep ☐ Not Visible ☒ None Observed  
Description: \_\_\_\_\_  
Staff Gage: Description: none

**Findings:**

- ☐ a. The reservoir was not inspected.  
☒ b. The reservoir appeared to be in satisfactory condition, no corrective actions are required at this time.  
☐ c. The reservoir appeared to be in fair to poor condition and requires corrective action.  
☐ d. The reservoir appeared to be in unsatisfactory condition, urgent corrective action is required.

**Corrective Actions:**

- ☐ e. The staff gage needs maintenance and/or repair. Description: \_\_\_\_\_  
☐ f. A staff gage was not observed at the reservoir. Provide some method of quantifying the water level within the reservoir.  
☐ g. A sinkhole was observed in the upstream reservoir. Conduct additional investigations and monitoring to identify the cause, risk and appropriate action.  
☐ h. \_\_\_\_\_

**4. Intake Works Description:**

☒ Number of Intakes 1  
☒ Intake Culvert / Pipe  
Size: \_\_\_\_\_ in. ☐ DIP ☐ Corrugated Metal ☐ PVC ☐ HDPE ☐ Concrete ☐ Other 3' box culvert  
Control: ☒ Gate ☐ Valve ☒ Flow can either be Shut off or Bypassed  
From: ☐ Stream Diversion ☐ Pump ☐ Reservoir ☒ Other Schofield Barracks Effluent  
Wahiana Reservoir  
☒ Ditch / Flume  
Dimension: 3' x 3' (Size x Depth) Shape Box  
Surface: ☐ Dirt ☐ Wood ☒ Concrete ☐ Lined w/ \_\_\_\_\_  
Control: ☒ Gate ☐ Valve ☒ Flow can either be Shut off or Bypassed  
From: ☐ Stream Diversion ☐ Pump ☐ Reservoir ☒ Other Schofield Barracks Effluent  
Wahiana Reservoir

**Findings:**

- ☐ a. The intake works were not inspected.  
☐ b. The intake works were not tested.  
☒ c. The intake works appeared to be in satisfactory condition, no corrective actions are required at this time.  
☐ d. The intake works appeared to be in fair to poor condition and requires corrective action.  
☐ e. The intake works appeared to be in unsatisfactory condition, urgent corrective action is required.

**Corrective Actions:**

- ☐ f. The intake works needs maintenance and/or repair. Description: \_\_\_\_\_  
☐ g. \_\_\_\_\_

Dam ID: OA-0021  
KEMOO 5 RESERVOIR

Inspection No: \_\_\_\_\_  
Date: 4/3/06

**5. Upstream Slope:**

(Typical Slope  $\pm$  1V : 1H) or less

Slope Protection: ☒ None ☐ Dumped Rock ☐ Fitted Rip Rap ☐ Grouted Rip Rap ☐ Liner \_\_\_\_\_ ☐ Other: \_\_\_\_\_

☐ Defect in Protection: Description: \_\_\_\_\_

Erosion: ☒ Loose soil w/ little vegetation ☐ Rut (<6") ☐ Gully (>6" deep) ☐ Not Visible ☐ None Observed

Description: \_\_\_\_\_

Cracks: ☐ Parallel with crest ☐ Perpendicular to crest ☐ Slide visible ☒ Not Visible ☒ None Observed

Description: \_\_\_\_\_

Sinkholes: ☐ # Observed: \_\_\_\_\_ Size: \_\_\_\_\_ and \_\_\_\_\_ Depth ☐ Not Visible ☒ None Observed

Description: \_\_\_\_\_

Vegetation: ☐ None ☒ Low Ground Cover ☐ Bushes or Tall Grass ☒ Trees # many ☐ <6" ☒ >6" & <20" ☐ >20"

Description: \_\_\_\_\_

**Findings:**

- ☐ a. The upstream slope was not inspected.
- ☒ b. The upstream slope appeared to be in satisfactory condition, no corrective actions are required at this time.
- ☐ c. The upstream slope appeared to be in fair to poor condition and requires corrective action.
- ☐ d. The upstream slope appeared to be in unsatisfactory condition and not expected to fulfill its intended function. Urgent corrective action is required.

**Corrective Actions:**

- ☐ e. Slope protection needs maintenance or repair. Description: \_\_\_\_\_
- ☐ f. Rut and/or Gully erosion was observed on the slope, which requires maintenance and/or repair. Description: \_\_\_\_\_
- ☐ g. A crack was observed on the slope, which requires further investigation to determine the underlining cause. Monitor the area and/or repair as required.
- ☐ h. A sinkhole was observed on the slope, which requires further investigation to determine the underlining cause. Repair and monitor the area.
- ☐ i. The upstream slope was not visible due to high grass and bush vegetation. Clear high vegetation and maintain low to enable easy visual inspection.
- ☐ j. Tree(s) were observed on the dam embankment. Trees have been identified as the probably cause of piping failures, and can possibly cause sever damage to the embankment if they are uprooted during a high winds. Corrective action is required to remove the tree hazards from the dam. Acceptable remedies include removal of the tree and its root structure down to a 2" diameter and reconstructing the damaged embankment section. All repair work shall be accomplished as per the requirements of licensed geotechnical or structural engineer. Routinely monitor the damaged area for signs of settlement and seepage.
- ☐ k. \_\_\_\_\_

Dam ID: OA-0021  
KEMOO 5 RESERVOIR

Inspection No: \_\_\_\_\_  
Date: 4/3/06

**6. Crest:**

Approximate Crest Width: 15'

Access: ☐ None ☐ Walking Path ☒ Roadway, Surface / Width / Usage: Dirt / 15' / Vehicle / Pedestrian

Erosion: ☐ Loose soil w/ little vegetation ☐ Rut (<6") ☐ Gully (>6" deep) ☐ Not Visible ☒ None Observed Access

Description: \_\_\_\_\_

Cracks: ☐ Parallel with crest ☐ Perpendicular to crest ☐ Slide visible ☐ Not Visible ☒ None Observed

Description: \_\_\_\_\_

Sinkholes: ☐ \_\_\_\_\_ in. Wide x \_\_\_\_\_ in. Long x \_\_\_\_\_ in. Deep ☐ Not Visible ☒ None Observed

Description: \_\_\_\_\_

Vegetation: ☐ None ☒ Low Ground Cover ☐ Bushes or Tall Grass ☐ Trees # \_\_\_\_\_ ☐ <6" ☐ >6" & <20" ☐ >20"

Description: \_\_\_\_\_

**Findings:**

- ☐ a. The dam crest was not inspected.
- ☒ b. The dam crest appeared to be in satisfactory condition, no corrective actions are required at this time.
- ☐ c. The dam crest appeared to be in fair to poor condition and requires corrective action.
- ☐ d. The dam crest appeared to be in unsatisfactory condition and not expected to fulfill its intended function. Urgent corrective action is required.

**Corrective Actions:**

- ☐ e. Access along the crest was satisfactory.
- ☐ f. Access along the crest was not possible. Description: \_\_\_\_\_
- ☐ g. Rut and/or Gully erosion was observed on the crest, which requires maintenance and/or repair. Description: \_\_\_\_\_
- ☐ h. A crack was observed on the crest, which requires further investigation to determine the underlining cause. Monitor the area and/or repair as required.
- ☐ i. A sinkhole was observed on the crest, which requires further investigation to determine the underlining cause. Repair and monitor the area.
- ☐ j. Portions of the crest were not visible due to high grass and bush vegetation. Clear high vegetation and maintain low to enable easy visual inspection.
- ☐ k. Tree(s) were observed along the dam crest. Trees have been identified as the probably cause of piping failures, and can possibly cause sever damage to the embankment if they are uprooted during a high winds. Corrective action is required to remove the tree hazards from the dam. Acceptable remedies include removal of the tree and its root structure down to a 2" diameter and reconstructing the damaged embankment section. All repair work shall be accomplished as per the requirements of licensed geotechnical or structural engineer. Routinely monitor the damaged area for signs of settlement and seepage.
- ☐ l. \_\_\_\_\_

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**7. Downstream Slope:**

(Typical Slope  $\pm$  1V : 1H) or less

Access: ☐ lower roadway along toe ☐ roadway to outlet works ☐ walkway to outlet works ☒ None Observed

Slope Protection: ☒ None ☐ Dumped Rock ☐ Rip Rap ☐ Grouted Rip Rap ☐ Concrete

Erosion: ☒ Loose soil w/ little vegetation ☐ Rut (<6") ☐ Gully (>6" deep) ☐ Not Visible ☐ None Observed

Description: \_\_\_\_\_

Cracks: ☐ Parallel with crest ☐ Perpendicular to crest ☐ Slide visible ☒ Not Visible ☒ None Observed

Description: \_\_\_\_\_

Sinkholes: ☐ \_\_\_\_\_ in. Wide x \_\_\_\_\_ in. Long x \_\_\_\_\_ in. Deep ☒ Not Visible ☒ None Observed

Description: \_\_\_\_\_

Vegetation: ☐ None ☒ Low Ground Cover ☐ Bushes or Tall Grass ☒ Trees # 6 ☐ <6" ☒ >6" & <20" ☐ >20"

Description: \_\_\_\_\_

Seepage: Seep Spot Number 1

☐ Green Vegetation ☐ Wet or Muddy Ground ☐ Ponding Water ☒ Not Visible ☐ None Observed

☐ Flowing, Description: \_\_\_\_\_

Water Clarity: ☐ Clear ☐ Some particles ☐ Muddy ☐ Other: \_\_\_\_\_

Description: \_\_\_\_\_

Seep Spot Number 2

☐ Green Vegetation ☐ Wet or Muddy Ground ☐ Ponding Water ☐ Not Visible ☐ None Observed

☐ Flowing, Description: \_\_\_\_\_

Water Clarity: ☐ Clear ☐ Some particles ☐ Muddy ☐ Other: \_\_\_\_\_

Description: \_\_\_\_\_

**Findings:**

- ☐ a. The downstream slope was not inspected.
- ☒ b. The downstream slope appeared to be in satisfactory condition, no corrective actions are required at this time.
- ☒ c. The downstream slope appeared to be in fair to poor condition and requires corrective action. *4/13/06 revision*
- ☐ d. The downstream slope appeared to be in unsatisfactory condition and not expected to fulfill its intended function. Urgent corrective action is required.

**Corrective Actions:**

- ☐ e. Slope protection needs maintenance or repair. Description: \_\_\_\_\_
- ☐ f. Rut and/or Gully erosion was observed on the slope, which requires maintenance and/or repair. Description: \_\_\_\_\_
- ☐ g. A crack was observed on the slope, which requires further investigation to determine the underlining cause. Monitor the area and/or repair as required.
- ☐ h. A sinkhole was observed on the slope, which requires further investigation to determine the underlining cause. Repair and monitor the area.
- ☐ i. The down stream slope was not visible due to high grass and bush vegetation. Clear high vegetation and maintain low to enable easy visual inspection.
- ☒ j. Tree(s) were observed on the downstream slope. Trees have been identified as the probably cause of piping failures, and can possibly cause sever damage to the embankment if they are uprooted during a high winds. Corrective action is required to remove the tree hazards from the dam. Acceptable remedies include removal of the tree and its root structure down to a 2" diameter and reconstructing the damaged embankment section. All repair work shall be accomplished as per the requirements of licensed geotechnical or structural engineer. Routinely monitor the damaged area for signs of settlement and seepage. *4/13/06*
- ☐ k. Seepage/Ponding water was observed. Monitor and conduct further investigation to locate the source of water and extent of any possible hazardous or developing condition.
- ☐ l. Seepage was observed flowing and particles were observed to be removed by the flow. Take immediate action to stop the loss of soil from the embankment. Conduct further investigation to determine the underlining cause and take corrective action. Monitor the area.
- ☒ m. The slope was very steep, around a 1 to 1 slope, further study is required to verify slope stability. *4/13/06*
- ☐ n. \_\_\_\_\_

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### 8. Abutments/Toe:

Erosion: ☐ Loose soil w/ little vegetation ☐ Rut (<6") ☐ Gully (>6" deep) ☐ Not Visible ☒ None Observed  
Description: \_\_\_\_\_

Cracks: ☐ Parallel with crest ☐ Perpendicular to crest ☐ Slide visible ☐ Not Visible ☒ None Observed  
Description: \_\_\_\_\_

Vegetation: ☐ None ☒ Low Ground Cover ☐ Bushes or Tall Grass ☐ Trees # \_\_\_\_\_ ☐ <6" ☐ >6" & <20" ☐ >20"  
Description: \_\_\_\_\_

Seepage: Seep Spot Number 1  
☐ Green Vegetation ☐ Wet or Muddy Ground ☐ Ponding Water ☐ Not Visible ☒ None Observed  
☐ Flowing, Description: \_\_\_\_\_  
Water Clarity: ☐ Clear ☐ Some particles ☐ Muddy ☐ Other: \_\_\_\_\_  
Description: \_\_\_\_\_

Seep Spot Number 2  
☐ Green Vegetation ☐ Wet or Muddy Ground ☐ Ponding Water ☐ Not Visible ☐ None Observed  
☐ Flowing, Description: \_\_\_\_\_  
Water Clarity: ☐ Clear ☐ Some particles ☐ Muddy ☐ Other: \_\_\_\_\_  
Description: \_\_\_\_\_

### Findings:

- ☒ a. The abutments/toe were not inspected.
- ☐ b. The abutments/toe appeared to be in satisfactory condition, no corrective actions are required at this time.
- ☐ c. The abutments/toe appeared to be in fair to poor condition and requires corrective action.
- ☐ d. The abutments/toe appeared to be in unsatisfactory condition and not expected to fulfill its intended function. Urgent corrective action is required.

### Corrective Actions:

- ☐ e. Slope protection needs maintenance or repair. Description: \_\_\_\_\_
- ☐ f. Rut and/or Gully erosion was observed, which requires maintenance and/or repair.  
Description: \_\_\_\_\_
- ☐ g. A crack was observed along the abutments/near the toe, which requires further investigation to determine the underlining cause. Monitor the area and/or repair as required.
- ☐ h. The abutment/toe area was not visible due to high grass and bush vegetation. Clear high vegetation and maintain low to enable easy visual inspection.
- ☐ i. Tree(s) were observed along the abutment/toe. Trees have been identified as the probably cause of piping failures, and can possibly cause sever damage to the embankment if they are uprooted during a high winds. Corrective action is required to remove the tree hazards from the dam. Acceptable remedies include removal of the tree and its root structure down to a 2" diameter and reconstructing the damaged embankment section. All repair work shall be accomplished as per the requirements of licensed geotechnical or structural engineer. Routinely monitor the damaged area for signs of settlement and seepage.
- ☐ j. Seepage/Ponding water was observed. Monitor and conduct further investigation to locate the source of water and extent of any possible hazardous or developing condition.
- ☐ k. Seepage was observed flowing and particles were observed to be removed by the flow. Take immediate action to stop the loss of soil from the embankment. Conduct further investigation to determine the underlining cause and take corrective action. Monitor the area.
- ☐ l. \_\_\_\_\_

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9. Outlet Works:

Culvert / Pipe

Type / Size: \_\_\_\_\_

Culvert: ☐ Concrete ☐ Masonry ☐ unlined earth ☐ Other \_\_\_\_\_

Pipe: ☐ DIP ☐ Corrugated Metal ☐ PVC ☐ HDPE ☐ Concrete ☐ Other \_\_\_\_\_

Control Type: ☐ Gate ☐ Valve ☐ Other \_\_\_\_\_

Location: ☐ Control on Upstream side ☐ Control on Downstream side

Seepage: ☐ Green Vegetation ☐ Wet or Muddy Ground ☐ Ponding Water ☐ Not Visible ☐ None Observed

☐ Flowing, Description: \_\_\_\_\_

Water Clarity: ☐ Clear ☐ Some particles ☐ Muddy ☐ Other: \_\_\_\_\_

Description: \_\_\_\_\_

**Findings:**

- ☒ a. The outlet works were not inspected.
- ☐ b. The outlet works were not tested.
- ☐ c. The outlet works appeared to be in satisfactory condition, no corrective actions are required at this time.
- ☐ d. The outlet works appeared to be in fair to poor condition and requires corrective action.
- ☐ e. The outlet works appeared to be in unsatisfactory condition and not expected to fulfill its intended function. Urgent corrective action is required.

**Corrective Actions:**

- ☐ f. Seepage/Ponding water was observed. Conduct further investigation to locate the source of water and extent of any possible hazardous or developing condition.
- ☐ g. Seepage was observed flowing and particles were observed to be removed by the flow. Take immediate action to stop the loss of soil. Conduct further investigation to determine the underlining cause and take corrective action. Monitor the area. Failures caused by seepage/piping along the outlet conduit are very common and are considered to be a dangerous situation.
- ☐ h. Were not visible due to high grass and bush vegetation. Clear high vegetation and maintain low to enable easy visual inspection.
- ☐ i. \_\_\_\_\_
- ☐ j. \_\_\_\_\_

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10. Spillway: None (Intake works, control flow)

Type: ☒ None ☐ Culvert/Pipe ☐ Channel

Description: \_\_\_\_\_

Dimension: \_\_\_\_\_ ft. Invert elevation: \_\_\_\_\_ ft. per staff gage

Slope Protection: ☐ None ☐ Grass ☐ Dumped Rock ☐ Fitted Rip Rap ☐ Grouted Rip Rap ☐ Concrete

☐ Defect in Protection: Description: \_\_\_\_\_

Approach: ☐ Clear ☐ High Veg. ☐ Trees ☐ Other: \_\_\_\_\_

Erosion: ☐ Scour ☐ Gully ☐ Headcut ☐ Not Observed ☐ Other: \_\_\_\_\_

Description: \_\_\_\_\_

Vegetation: ☐ None ☐ Low Ground Cover ☐ Bushes or Tall Grass ☐ Trees # \_\_\_\_\_ ☐ <6" ☐ >6" & <20" ☐ >20"

Description: \_\_\_\_\_

**Findings:**

- ☐ a. The Spillway appeared to be in satisfactory condition, no corrective actions are required at this time.
- ☐ b. The Spillway appeared to be in fair to poor condition and requires corrective action.
- ☒ c. The Spillway appeared to be in unsatisfactory condition and not expected to fulfill its intended function. Urgent corrective action is required. 4/23/06  
revised

**Corrective Actions:**

- ☐ d. Slope protection needs maintenance or repair. Description: \_\_\_\_\_
- ☐ e. The spillway approach was blocked. Clear approach.
- ☐ f. Severe scour erosion was observed which requires maintenance and/or repair.  
Description: \_\_\_\_\_
- ☐ g. A headcut (vertical drop in channel due to erosion) was observed downstream of the spillway. Corrective action is required to prevent this problem from moving upstream.
- ☐ h. Trees are unacceptable in the spillway channel and approach. Take corrective action to address the woody vegetation problem and repair the damaged area.
- ☐ i. Unclear if spillway is adequately sized. Spillway should pass the probable maximum flood. Verify spillway capacity and take corrective action as required.
- ☒ j. Provide Spillway or other mitigative action to prevent overtopping. 4/23/06

11. Down Stream Channel:

Name: \_\_\_\_\_

Downstream: ☐ Sump ☐ Open Area ☐ Un-Defined Drainage-way ☐ Defined Drainage-way ☐ Other \_\_\_\_\_

Items along Stream Bank: ☐ None ☐ Road ☐ Houses ☐ Town ☐ Not Inspected

Description: \_\_\_\_\_

**Findings:**

- ☒ a. The downstream channel was not inspected.
- ☐ b. The downstream channel appeared to be in satisfactory condition, no corrective actions are required at this time.
- ☐ c. The downstream channel appeared to be in fair to poor condition and requires corrective action.
- ☐ d. The downstream channel appeared to be in unsatisfactory condition and not expected to fulfill its intended function. Urgent corrective action is required.

**Corrective Actions:**

- ☐ e. \_\_\_\_\_

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**Additional Comments:**

On the date of this limited visual inspection, there appeared to be no immediate threat to the safety of the dam. No assurance can be made regarding the dam's condition after this date. Subsequent adverse weather and other factors may affect the dam's condition.

**Limitations and Intent of this Dam Safety Inspection:**

This Dam Safety Inspection was conducted to assess the general overall condition of the reservoir/dam, identify visible deficiencies, and recommend areas of for monitoring, additional investigative studies and corrective actions. The inspection is based only on visible features/areas of the dam on the day of inspection. This inspection is not a formal phase I or phase II dam safety inspection and does not include a review or evaluation from each specialist of an inspection team, such as a geologists, civil, geotechnical, structural, or hydraulics engineer. The owner should verify the findings of this report and take corrective actions. The owner may submit to the State alternative corrective actions that are certified by a licensed professional engineer in the State of Hawaii experienced in the design and construction of dams. This inspection does not relieve the owner/operator from their responsibility to conduct routine inspections, maintenance, repairs, modifications, monitoring, documentation, and/or investigative studies. The inspection was conducted under the authority of the Hawaii Revised Statutes Chapter 179D, and Hawaii Administrative Rules, Title 13, Chapter 190, titled "Dams and Reservoirs". Questions regarding this inspection should be forwarded to the Hawaii State Dam Safety Program; PO Box 373; Honolulu, Hawaii 96809; Ph. (808) 587-0236.

*Revised: Dec. 1, 2003*